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Certified by

Jon W Dudas

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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

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INVENTOR(S)

Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
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Additional inventors are being named on the ______ *separately numbered sheets attached hereto*

TITLE OF THE INVENTION (500 characters max)

Acoustic Projector Having Minimized Mechanical Stresses

Direct all correspondence to: **CORRESPONDENCE ADDRESS**

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ENCLOSED APPLICATION PARTS (*check all that apply*)

☑ Specification *Number of Pages* 7
☑ Drawing(s) *Number of Sheets* 2
☐ Application Date Sheet. See 37 CFR 1.76
☐ CD(s), Number ______
☐ Other (specify) ______

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT

☐ Applicant claims small entity status. See 37 CFR 1.27.
☐ A check or money order is enclosed to cover the filing fees.
☑ The Director is herby authorized to charge filing fees or credit any overpayment to Deposit Account Number: 190130
☐ Payment by credit card. Form PTO-2038 is attached.

FILING FEE Amount ($): 160.00

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☑ No.
☐ Yes, the name of the U.S. Government agency and the Government contract number are: ______

Respectfully submitted,

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Date 12/12/03

REGISTRATION NO. 29,404
(if appropriate)
Docket Number: 20030095 PRO

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

EXPRESS MAIL CERTIFICATE EL 974386714 US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: OSBORN, et al.

Filed: Herein Dkt. No: 20030095 PRO

For: Acoustic Projector Having Minimized Mechanical Stresses

CERTIFICATE OF MAILING 37 CFR 1.10: I certify that this correspondence is being deposited on the below date with the U.S. Postal Service with sufficient postage as EXPRESS MAIL TO ADDRESSEE addressed to: US Patent and Trademark Office, 2011 South Clark Place, Customer Window, Mail Stop Provisional Application, Crystal Plaza Two, Lobby, Room 1B03, Arlington, VA 22202

Date: 12-12-03 Gloria Abbasciano

Gloria Abbasciano

Dear Honorable Commissioner:

LETTER OF TRANSMITTAL

Submitted herewith is a Provisional Patent Application consisting of 1 pages of cover sheet, 7 pages of specification and claims, 2 sheets of drawings.

DEPOSIT ACCOUNT 190130 AUTHORIZATION – The Office is hereby authorized to charge the required fee, and any deficiency or credit any overpayment in the fees to the above deposit account, owned by BAE SYSTEMS Information and Electronic Systems Integration Inc.

Respectfully submitted,

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ACOUSTIC PROJECTOR HAVING MINIMIZED MECHANICAL STRESSES

Background of the Invention

1. Field of the Invention

The present invention relates to underwater acoustics and more particularly to acoustic projectors.

2. Brief Description of Prior Developments

In the deployment of low frequency underwater acoustic projectors effective management of mechanical stresses within the radiating device are a critical design issue that must be addressed to ensure successful operations over a wide range of depths and acoustic dynamic range. One of the stresses most difficult to manage is the z-axis stress or stress along the length of the projector. This stress is particularly difficult to manage when these devices use a filament wound composite shell component to serve as the primary mechanical structure within the radiating device.

The prior art method of slotted cylinder projector design was to concentrate on achieving high hoop modulus (circumference modulus) of a graphite/epoxy shell. In the winding process the manufacturer achieves high hoop modulus by having a wind angle near 90 degrees which reduced the z-axis modulus (in the length direction)

Having a reduced Z-axis modulus means the stiffness in the z-direction is reduced and thus during operation and depth excursion the stress in that direction are increased. Not adhering to reduced dynamic range and depth could result in mechanical failure. For

typical slotted cylinder projector operation and size limits, this increased stress reduces the depth and dynamic range capability if the slotted Cylinder projector.

A need, therefore, exists for an acoustic projector construction in which mechanical stresses are minimized so as to increase depth performance and dynamic.

Summary of Invention

To solve this problem the acoustic projector shell can be assembled with a metallic liner along the ID of the shell. This metallic liner provides increases stiffness in the Z-axis direction (along the axial length of the projector), which reduced stress. The metallic liner can be any metal, aluminum, steel, titanium, brass, etc. An additional method of increasing the Z-axis stiffness (modulus) is to change the wind angle, or introduce longitudinal fibers along the length of a graphite/epoxy or other composite, filament wound shell. The one advantage the metallic liner has over the composite wound solution is that the shell can be any material and the modulus in the hoop direction (circumference) is unchanged, thus the resonance or tuned frequency of operation is unchanged.

In the method and apparatus of this invention, a slotted cylinder projector graphite shell, which includes a metallic liner or increased graphite stiffness in the z direction, reduces stress in the projector along the z direction, which significantly increases the depth of operation and dynamic range of the projector. These improvements can be made without sacrificing other performance metrics, such as bandwidth, source level or efficiency.

Brief Description of the Drawings

The present invention is further described with reference to the accompanying drawings wherein:

Figure 1 is a perspective view of a preferred embodiment of a single sheel segment of the acoustic projector of the presentation;

Figure 2 is a vertical cross section of an alternate preferred embodiment of the acoustic projection of the present invention; and

Figure 3 is a prior art ¼ symmetry model.

Detailed Description of the Preferred Embodiment

The improvements to the construction of the slotted cylinder to reduce mechanical stress requires either the addition of a metallic liner to the inner diameter of the shell. Figure one shows an isometric drawing of an assembled shell segment that has a metallic liner on the inner diameter of the graphite epoxy shell. Figure 2 shows a cross section of a similar shell segment that also shows the metallic liner on the inner diameter of the graphite/epoxy shell. This liner covers the entire length of the shell and covers the complete inner diameter of the shell. The metallic liner is usually placed between the inner diameter of the shell and the outer diameter of the insulation a material. The metallic liner can be any metallic material, steel, aluminum, titanium, brass, etc.

The stiffness of the material used for the metallic liner as well as the thickness of that liner, controls the stiffness in the z or axial direction of the projector. The liner material and thickness can also be changed to adjust the resonance frequency and bandwidth of the projector. Additionally, the metallic liner does not have to be of uniform

thickness in the hoop or circumferential direction. A tapered liner can provide needed stiffness near the node (opposite the slot), while being tapered toward the slot to reduce weight and effects on acoustic performance. An optimal design would be the inclusion of the metallic liner with no negative effects, perhaps improving effects on the acoustic response, a significant increase in operation and survival depth capabilities, as well as an increase in dynamic range capability.

As with the metallic liner, adjusting the graphic/epoxy shell wind angle and fiber content can also adjust the stiffness in the Z or axial direction. Methods for adjusting the modulus of the axial direction are well know by those familiar with graphite tube manufacture. These methods include reducing the wind angle, such that a higher percentage of fiber is in the axial direction, during the winding process. An additional method of achieving higher axial stiffness is to lay high modulus fibers, in the axial direction, between the winding layer.

A disadvantage of using the graphite wind technique to change the modulus, versus adding a metallic liner, is that the hoop or circumferential direction modulus will always be effected. In most cases the hoop modulus will be reduced when the axial modulus is increased. This reduction in the hoop direction modulus is undesirable depth operation of the slotted cylinder projector because the shell modulus and strength are the primary support structure of the projector. Additionally, when the hoop modulus decreases the resonance also decreases and thus to maintain acoustic and depth performance additional shell thickness is needed.

The improved construction method of slotted cylinder projectors is similar to the prior art in the fact that it is produced from layers of cylindrical material. However,

the prior art does not include an important improvement of additional metallic layer between the inner diameter of the shell and outer diameter of the insulation material. Figure 4 is a ¼ symmetry model of the prior art of an SCP with no metallic liner.

While the present invention has been described in connection with the preferred embodiments of the various figures, it is to be understood that other similar embodiments may be used or modifications and additions may be made to the described embodiment for performing the same function of the present invention without deviating therefrom. Therefore, the present invention should not be limited to any single embodiment, but rather construed in breadth and scope in accordance with the recitation of the appended claims.

Claims

What is claimed is:

1. In a cylindrical projector having a longitudinal shot and comprising an outer shell and an inner concentric insulative layer, wherein the improvement comprises a metallic liner.

Abstract

In a cylindrical projector having a longitudinal shot and comprising an outer shell and an inner concentric insulative layer, wherein the improvement comprises a metallic liner.

Drawings

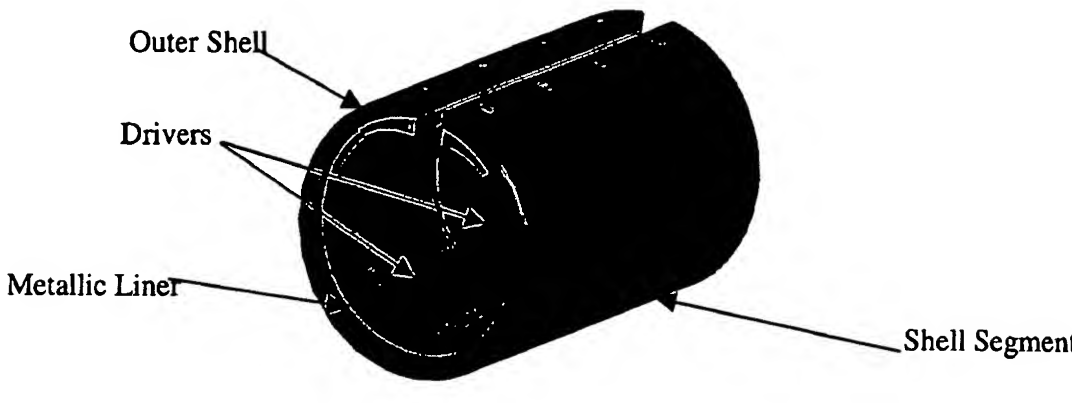

Figure 1

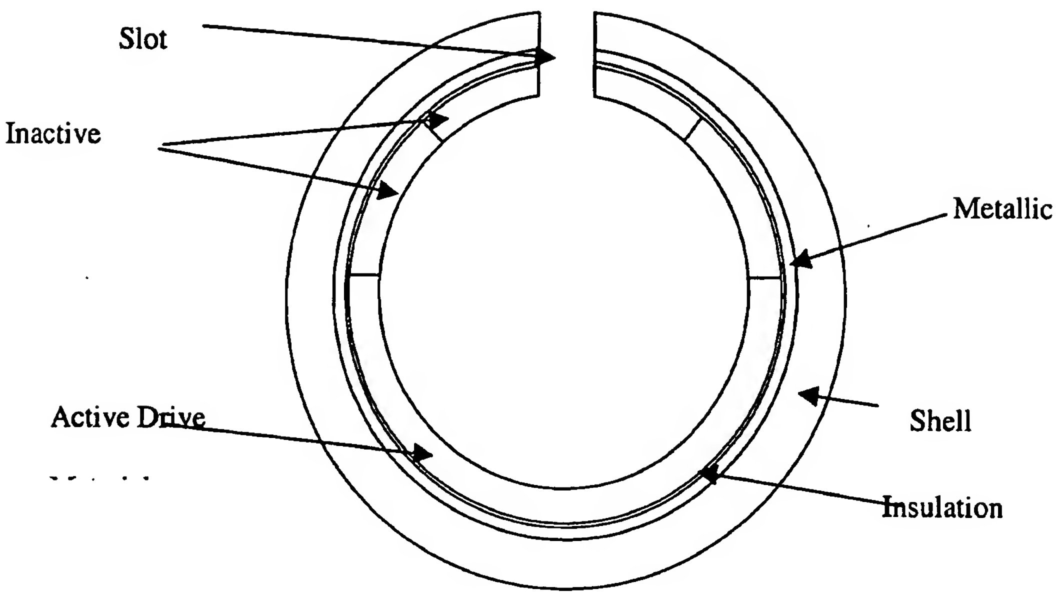

Figure 2

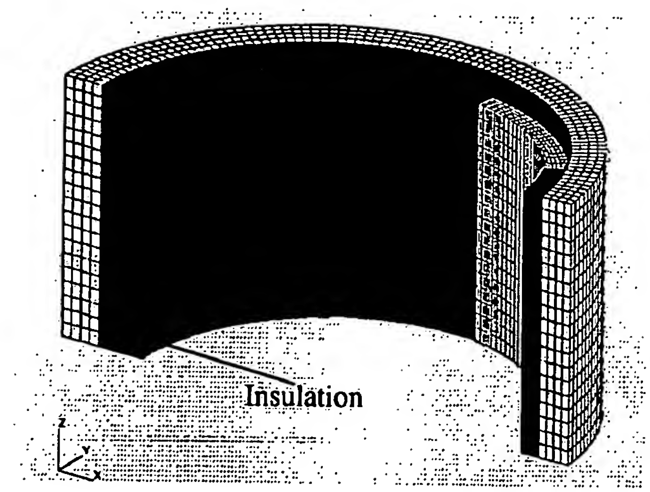

Figure 3

Document made available under the Patent Cooperation Treaty (PCT)

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